

*REMARKS/ARGUMENTS**The Pending Claims*

Claims 1-6, 9, 10, 12-15, and 17-24 currently are pending and are directed to microcapsules comprising a core containing at least one rubber additive, at least two shells made of an amino resin or phenol formaldehyde resin, and a sliding or wearing layer applied to the surface of the microcapsules.

Amendments to the Claims

Claim 1 has been amended to incorporate the features of claim 11. Support for this amendment can be found at, e.g., page 7, ¶ 4, and original claim 11. In view of the amendment to claim 1, claim 11 has been cancelled.

Claim 10 has been amended to specify that the shells of the microcapsule together have a thickness between 30 to 100 nm. Support for this amendment can be found at, e.g., page 7, ¶ 4, and original claim 10.

No new matter has been added by way of these amendments.

Summary of the Office Action

Claims 1-5, 8-11, and 22-24 have been rejected under 35 U.S.C. § 103(a) as allegedly obvious over US Patent Application Publication 2003/0165682 (Menting et al.). Claim 6 has been rejected under 35 U.S.C. § 103(a) as allegedly obvious over Menting in view of US Patent 2,623,079 (Johnson). Claims 12-15 and 17-21 have been rejected under 35 U.S.C. § 103(a) as allegedly obvious over Menting in view of US Patent 4,670,344 (Okada et al.).

Discussion of Rejections Under 35 U.S.C. § 103(a)

The obviousness rejections are respectfully traversed for the reasons set forth below.

Menting et al. is directed to microcapsules comprising a composition containing a rubber additive encased in a coating material. Accordingly, Menting et al. characterizes these coating materials as being selected from substances like waxes, paraffins or specific polymers. The coating materials of Menting et al. are more akin to the materials identified for the sliding or wearing layer of the microcapsules of the present invention. Furthermore, Menting et al. teaches microcapsules with layers and an additive core significantly different from the instant invention in terms of thickness of each layer or component and therefore the particle size of the resultant microcapsule itself.

In Example 6, Menting et al. teaches the further conversion of microcapsules which were prepared according to one of Examples 1-5. Example 1 discloses that microencapsulated 2-mercapto-benzothiazole (MBT) powder is ground to an average particle size of 5 μm and micro-encapsulated with poly-ethylene wax. The resulting microcapsules have an average diameter of approximately 5 μm . Thus, the thickness of the shell produced in Example 1 of Menting et al. is considerably low compared to the size of the MBT powder starting material.

Example 6 discloses coating the microcapsule of Example 1 with a low-melting, wax-like substance (e.g., pentaerythritoltetra-stearate or mineral oil) to obtain macroscopic beads of 0.1-10 mm (i.e., 100 to 10,000 microns). Example 6 therefore teaches an increase in diameter by a factor of 20 to 2,000. The resultant beads of Example 6 (which can no longer be referred to as microcapsules) have significant disadvantages as compared to the invention recited in the pending claims. Specifically, the relative load of the rubber additive of the beads disclosed in Example 6 of Menting et al. is lowered by a factor being proportional to the relationship of the radii of the respective capsules to their cube. Following the Office's logic, a 5 micron diameter bead coated such that its resultant diameter is 100 microns indeed has a 95 micron thick coating (including its shells and waxy-coating substance). However, the Office does not acknowledge that such an increase in the outer layers has the direct effect of over-diluting the rubber additive contained inside. Rather, an increase in diameter of the capsules from 5 microns to 100 microns would dilute the rubber additive in the beads by a factor of at least 1,650, which can be roughly estimated when taking into account a radius of 2.5 μm for the microcapsules and 50 μm for the resulting beads. Furthermore, if the beads disclosed in Example 6 of Menting et al. have a diameter of 10 mm in size, the rubber additives are diluted by a factor of roughly 1.5 billion.

The claimed invention does not present the same problems as Menting et al. because the invention recited in the pending claims is limited to microcapsules, i.e., microscopic particles. Menting et al. teaches the preparation of macroscopic beads containing a comparatively low amount of rubber additives by additionally coating microcapsules with a thick waxy-layer. In contrast, the present invention, as recited in the pending claims, has a by far higher content or concentration of the rubber additive. Therefore, the claimed microcapsules have several distinct advantages over the beads of Menting et al., including being more economical and avoiding the introduction of an excess of undesired materials, such as waxes, etc., into the rubbers to be processed.

Johnson and Okada et al. do not compensate for the deficiencies of Menting et al. Rather, each of Johnson, Okada et al., and Menting et al. is silent with regard to reducing the thickness of the wearing layer (or coating) to be in a range which lies in the nanometer scale. The invention recited in the pending claims provides such microcapsules with their attendant advantages and, in at least this respect, is superior to the cited references.

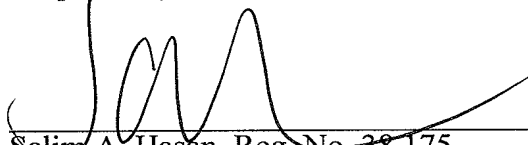
Moreover, the claimed invention is superior to the beads disclosed in Menting et al. based on their ability to achieve a microcapsule with high mechanical stability under mastication conditions and with a wall material that can be destroyed in the vulcanization step. The Examples provided in the instant application demonstrate the surprising and unexpected success of the claimed microcapsules at achieving this objective. As described in Examples 2-14, the claimed microcapsules resulted in the ability to lower the amount of extractable sulfur by magnitudes, as well as dual-layer microcapsules with superior stability over mono-layer microcapsules. In contrast to the claimed microcapsules, the beads of Menting et al., encased in waxes or polymers, will likely be deformed, destroyed, or dissolved under normal processing and compounding conditions.

Because the cited references, taken alone or in combination, fail to teach or suggest each and every element of the pending claims as amended, Applicants respectfully submit that the obviousness rejections are improper and should be withdrawn.

Conclusion

Applicants respectfully submit that the patent application is in condition for allowance. If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,



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